REMARKS

Claims 1 – 26 are currently pending and under consideration. With this Amendment, Claims 1, 14, 19, and 23 have been amended. Thus, after entry of this Amendment, Claims 1 – 26 are pending and under consideration. The amendments of Claims 1, 14, 19, and 23 and rejections of Claims 1 – 26 are addressed in detail, below.

The Amendments of the Claims

Claim 1 has been amended to more clearly recite the implicit limitation that the set point temperature is accelerated and then decelerated at a finite acceleration/deceleration rate. Claim 19 has been similarly amended to explicitly include this limitation. The amendment to Claims 1 and 19 is supported throughout the specification and claims as originally filed, including for example, the disclosure at page 6, lines 17-91 and at page 9, lines 10-22. Claims 14 and 23 have been amended to provide proper antecedent basis for the "control temperature" recited in Claims 15, 16, 24, and 25. This amendment is supported throughout the specification and claims as originally filed, including for example, the disclosure at page 7, line 27 through page 8, line 4.

Applicant further notes that the limitations added by amendment herein to Claims 1 and 19 were implicitly part of original Claim 19 when read in light of the specification. However, the requirement that the acceleration and deceleration rates be finite has been added to expedite prosecution of this application. Therefore, the proposed amendment does not narrow the scope of Claims 1 or 19 or any of the claims dependent therefrom.

Claim Rejections – 35 U.S.C. § 102

Claims 19, 20, and 22-26 stand rejected under 35 U.S.C. § 102(e) as allegedly anticipated by U.S. Patent No. 6,207,937 to Stoddard *et al.* (hereinafter "Stoddard"). Applicants traverse the rejection.

In order to anticipate under 35 U.S.C. §102(e), a cited reference must teach each and every limitation of the rejected claim. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); MPEP §2131. The Examiner has cited FIG. 8 of Stoddard as teaching the acceleration and deceleration rates of the presently claimed invention. However, Stoddard does not provide any teaching or even a suggestion regarding the use of *finite* temperature acceleration and deceleration rates. As described at Col. 16, line 57 through Col. 17, line 9, FIG. 8 shows a modified ramp function in which the target setpoint

temperature (T_{OUTPUT}) is instantaneously increased at a first, minimum ramp rate, R_{MIN} from $T_{INITIAL}$ to a preset percentage (Y% * T_{SP}) of the setpoint temperature (T_{SP}). When T_{OUTPUT} reaches Y% * T_{SP}, the temperature ramp rate is instantaneously increased to the maximum ramp rate, R_{MAX} which is maintained until T_{OUTPUT} reaches a second preset percentage (X% * T_{SP}) of the setpoint temperature (T_{SP}). The ramp rate then instantaneously decreases to R_{MIN} until T_{SP} is reached when the temperature ramp rate is instantaneously reduced to zero. FIG. 8 of Stoddard differs from the top panel of FIG. 1 (Prior Art) in the instant application only in the use of three constant ramp rate phases instead of the single phase shown in FIG. 1 of the instant application. As illustrated in the panel 2 of FIG. 1, the ramp rate (first derivative of temperature vs. time or dT/dt, where T is temperature and t is time) for each such constant ramp rate phase is a step function with infinite slope at the start and end of the constant ramp rate phase. As a result, the temperature *acceleration* rate (second derivative of temperature or d^2T/dt^2), shown in the third panel from the top of FIG. 1 is zero except at the beginning and end of the constant ramp rate phase where it is positive or negative infinity, respectively. For the temperature program shown in FIG. 8 of Stoddard, d^2T/dt^2 is infinite at the start and end of the program as well as at the beginning and end of the R_{MAX} phase. In short, at every point on the temperature vs. time "curve" where the programmed temperature (T_{OUTPUT}) is discontinuous, the acceleration is either infinitely positive or infinitely negative. Because the infinite acceleration and deceleration rates called for by the temperature program are not physically attainable by the physical body being heated, the actual temperature of the body (panel 4 of FIG. 1) oscillates above and below the programmed temperature as the power supplied to the heating elements (panel 5 of FIG. 1) also oscillates in response to the unstable temperature profile.

In contrast, the present invention, as recited in Claim 19, includes a furnace having a temperature controller with control software that accelerates the temperature setpoint from the starting temperature at a finite and therefore physically achievable rate as shown in the third panel from the top of FIG. 2. When the programmed temperature reaches the desired end temperature, the temperature ramp rate is then likewise gradually decelerated at a finite rate to a zero temperature ramp rate to smoothly provide a constant ending temperature. FIG. 2 (panel 2) illustrates how this results in a gradual increase in the ramp rate. The upward slope of the ramp rate in panel 2 of FIG. 2 has a slope equal to the acceleration rate shown in panel 3 of FIG. 2.. When the maximum ramp rate is reached, the ramp rate becomes constant with time while the

acceleration rate (panel 3 of FIG. 2) is zero. As the target temperature is approached, the acceleration rate becomes finitely negative in the *deceleration* phase. The ramp rate (panel 2 of FIG. 2) gradually returns to zero with a negative slope equal to the deceleration rate.

The initial and ending "R_{MIN}" phases shown in Stoddard and identified by the Examiner as temperature "acceleration" and "deceleration" phases are actually nothing more than periods of lower constant ramp rate. There is no finite acceleration or deceleration phase as in the instantly claimed invention. As a further illustration of this important distinction, FIG. 8 in Stoddard should be compared with the top panel of FIG. 2 in the instant application. Whereas the temperature setpoint vs. time function for a furnace and method of the present invention is continuous and smooth, the temperature setpoint vs. time function taught by Stoddard includes four discontinuities where the temperature ramp rate instantaneously changes, thereby requiring instant temperature acceleration. As explained by analogy in the specification at page 6, lines 1-4, a physical object cannot be instantaneously accelerated from rest to a non-zero velocity. The same is true for temperature changes in a physical body. Instantaneous acceleration and/or deceleration of the temperature ramp rate is not physically possible. The presently claimed invention solves this problem by accelerating the programmed temperature at a finite, physically attainable rate that results in closer conformance of the actual body temperature to the programmed temperature profile (panel 4 of FIG. 2) and substantially fewer and less dramatic oscillations in the power load for the heating elements (panel 5 of FIG. 2).

For this and the foregoing reasons, Applicants submit that Stoddard fails to anticipate Claim 19 (and Claims 20 and 22-26 that depend therefrom), and respectfully request that rejection be withdrawn.

Claim Rejections – 35 U.S.C. § 103

Claims 1 – 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Stoddard in view of U.S. Patent No. 4,669,040 to Petit *et al.* (hereinafter referred to as "Petit"). Applicants traverse the rejection on the ground that the Patent Office has failed to establish a prima facie case of obviousness.

To establish a proper *prima facie* case, three criteria must be met. First, there must be some suggestion or motivation, either in the cited references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the cited reference teachings in the manner suggested by the Patent Office. Second, there must be a reasonable

expectation that the suggested modification or combination would be successful. Finally, the prior art reference (or references when combined) must teach or suggest each and every limitation of the rejected claims. The teaching or suggestion to make the claimed modification or combination and the reasonable expectation of success must both be found in the prior art, and not based upon in the applicant's disclosure. *See, e.g., In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP § 2143. If *prima facie* obviousness is not established, the rejection fails and Applicants are not required to produce evidence of non-obviousness. MPEP § 2142. Moreover, the use of impermissible hindsight on the part of the Patent Office must be avoided. *Id.*

As discussed above, Stoddard does not teach a method of temperature control that includes the use of finite temperature acceleration and deceleration rates according to the presently claimed invention. The Examiner has cited Petit as "showing the use of 'Approach Control.' (Col 2 lines 30-40) to prevent overshoot." Petit teaches a method for self-tuning a Proportional Integral-Derivative controller to react to new input parameters such as new heater elements and/or a heated body with different thermal inertia. A system is subjected to perturbations under automated feedback control and system control parameters are determined based on responses to the perturbations. Petit does not provide any teaching or suggestion that would have lead one of skill in the art at the time of the present invention to consider the use of finite acceleration and/or deceleration rates in general or more specifically to modify the teachings of Stoddard to obtain the instantly claimed invention as recited in independent claims 1 and 10. Rejected Claims 2 – 9 and 11 – 18 depend from Claims 1 and 10, respectively , and therefore include the patentable limitations of the base claims. Withdrawal of the rejection of Claims 1 – 18 under 35 U.S.C. §103(a) is therefore requested.

Dependent Claims 3 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Stoddard in view of Petit and further in view of U.S. Patent No. 4,842,686 to Davis *et al.* (hereinafter referred to as "Davis"). Applicant traverses this rejection. Claims 1 and 10 are patentable over Stoddard in view of Petit as discussed above. Claims 3 and 12 depend from independent Claims 1 and 10 and therefore include the limitations of the base claims. Davis teaches the use of radiant heat lamps to raise the temperature of semiconductor wafers during processing. However, Davis does not teach or suggest in any way the use of finite temperature acceleration and deceleration rates in a method of heating a body in a furnace as

claimed in the instant application. Withdrawal of the rejection of Claims 3 and 12 under 35 U.S.C. §103(a) is therefore requested.

Claim 21 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Stoddard in view of Davis. As noted above, Davis teaches the use of radiant heat lamps but does not teach or suggest in any way the use of finite temperature acceleration and deceleration rates in the process software of a temperature controller in a furnace as claimed in the instant application. Withdrawal of the rejection of Claim 21 under 35 U.S.C. §103(a) is therefore requested.

Conclusion

Based on the foregoing, Applicants respectfully submit that claims 1 - 26 are in condition for allowance. An early indication of the same is therefore kindly requested. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned agent at the telephone number listed below. No fees beyond those included with the Amendment are believed due. However, the Commissioner is authorized to charge any additional required fees, or credit any overpayment, to Dorsey & Whitney LLP Deposit Account No. 50-2319 (Order No. A-69448/MSS/MDV (463035-00033)).

Respectfully submitted,

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